

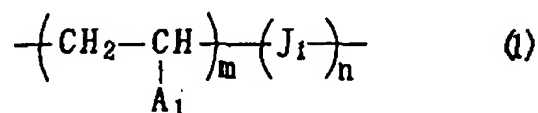
U.S. Patent Application Serial No. 10/615,775
Amendment filed December 20, 2005
Reply to OA dated September 22, 2005

AMENDMENTS TO THE CLAIMS:

Please cancel claims 5 and 7-9 without prejudice or disclaimer, amend claims 4, 6, 10, 11, and 16-22, and add new claims 25 and 26, as follows. This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

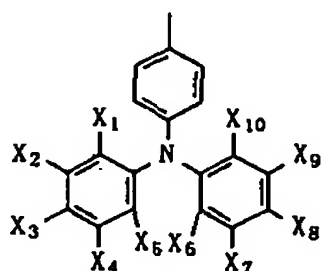
Claim 1 (Original): A diarylamino group-containing copolymer comprising a molecular chain represented by the formula (1):



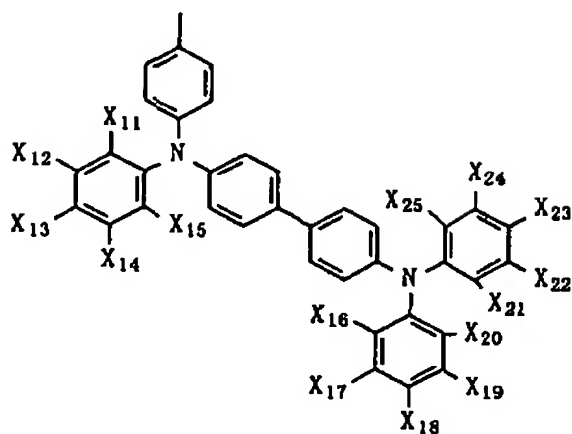
and molecular chain terminals which are each independently a radical polymerization initiator residue or a hydrogen atom, the copolymer having a degree of polymerization of 3 to 500,

wherein, in the formula (1),

A₁ represents a group represented by the formula (2) or (3):



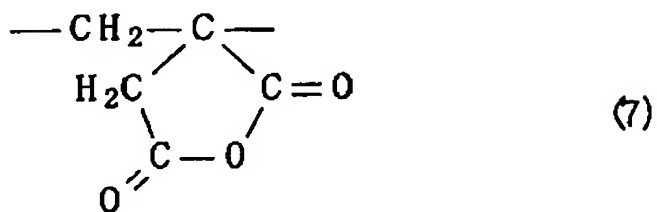
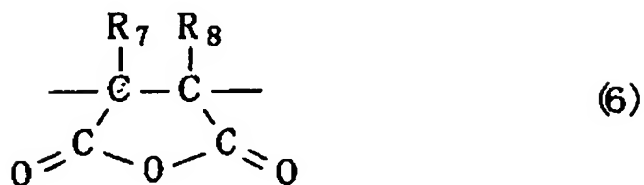
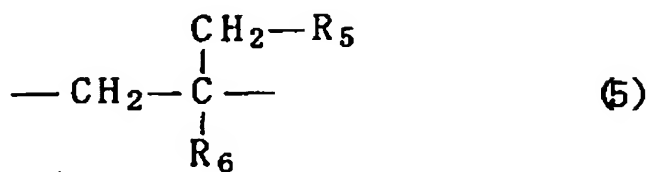
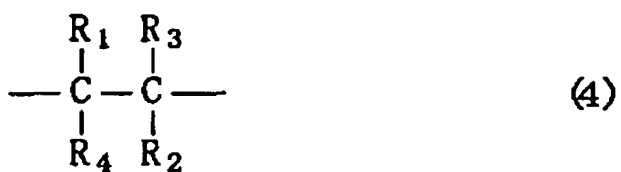
(2)



(3)

and in the formulas (2) and (3), X₁ to X₂₅ each independently represents a hydrogen atom, a halogen atom, a C₁ to C₂₂ alkyl group, a C₁ to C₂₂ alkylthio group, a C₁ to C₂₂ alkoxy group which may be substituted with a halogen atom, an N,N-dialkylamino group in which each alkyl group is a C₁ to C₂₂ alkyl group, a phenyl group, or an N,N-diphenylamino group,

J₁ represents a repeating unit represented by any of the formulas (4) to (7):



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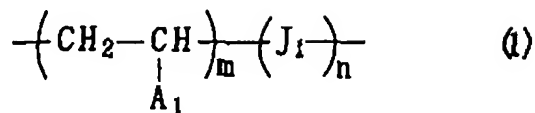
and in the formulas (4) to (7), R_1 to R_6 each independently represents a hydrogen atom, a C_1 to C_4 alkyl group, a carboxyl group, or an alkyloxycarbonyl group in which the alkyl group is a C_1 to C_{22} alkyl group, R_7 and R_8 each independently represents a hydrogen atom or a C_1 to C_4 alkyl group, with the proviso that at least two of R_1 to R_4 represent a carboxyl group and at least one of R_5 and R_6 represents a carboxyl group, and

m and n represent positive numbers.

Claim 2 (Original): The diarylamino group-containing copolymer according to claim 1, wherein a ratio of m to n , $m:n$, is from 1:1 to 4:1.

Claim 3 (Original): The diarylamino group-containing copolymer according to claim 1, wherein the degree of polymerization is within a range of 10 to 200.

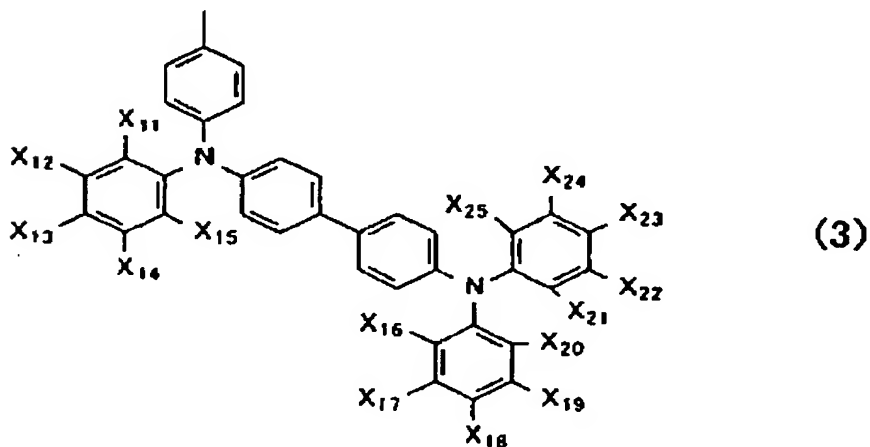
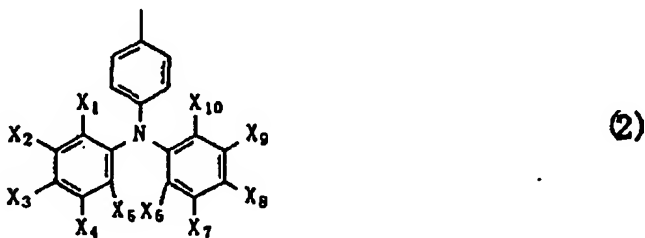
Claim 4 (Currently amended): An organic electroluminescent device comprising an anode, a hole transport layer, an emitter layer and a cathode, which are provided on a transparent support, wherein the hole transport layer comprises a layer made of a copolymer represented by following formula (8): diarylamino group-containing copolymer comprising a molecular chain represented by the formula (1):



and molecular chain terminals which are each independently a radical polymerization initiator residue or a hydrogen atom, the copolymer having a degree of polymerization of 3 to 500,

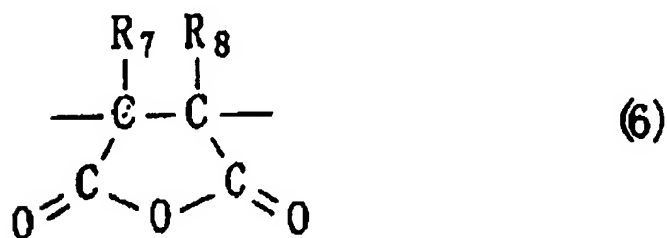
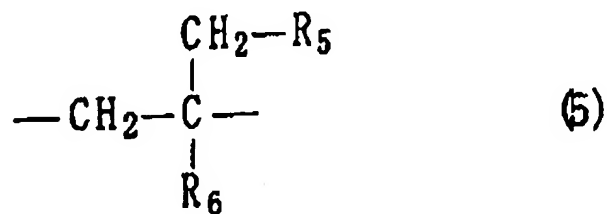
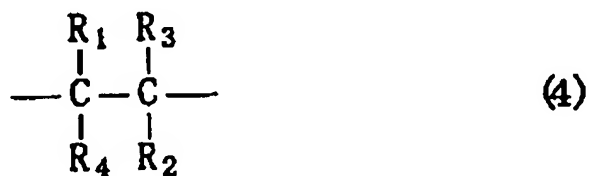
wherein, in the formula (1),

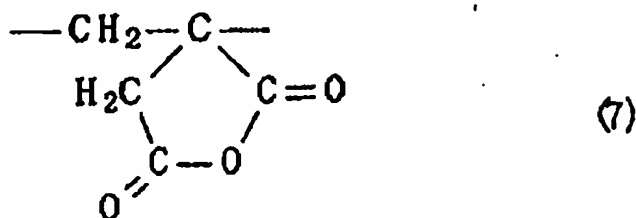
A₁ represents a group represented by the formula (2) or (3):



and in the formulas (2) and (3), X_1 to X_{25} each independently represents a hydrogen atom, a halogen atom, a C_1 to C_{22} alkyl group, a C_1 to C_{22} alkylthio group, a C_1 to C_{22} alkoxy group which may be substituted with a halogen atom, an N,N-dialkylamino group in which each alkyl group is a C_1 to C_{22} alkyl group, a phenyl group, or an N,N-diphenylamino group.

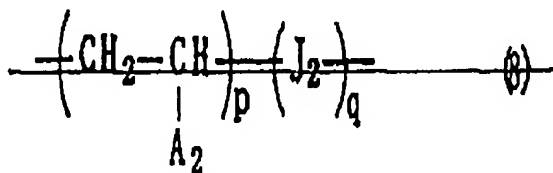
J_1 represents a repeating unit represented by any of the formulas (4) to (7):





and in the formulas (4) to (7), R₁ to R₆ each independently represents a hydrogen atom, a C₁ to C₄ alkyl group, a carboxyl group, or an alkyloxycarbonyl group in which the alkyl group is a C₁ to C₂₂ alkyl group, R₇ and R₈ each independently represents a hydrogen atom or a C₁ to C₄ alkyl group, with the proviso that at least two of R₁ to R₄ represent a carboxyl group and at least one of R₅ and R₆ represents a carboxyl group, and

m and n represent positive numbers



~~and in the formula (8), A₂ represents a group selected from the group consisting of an N,N-diaryl-substituted amino group, a group having an N,N-diaryl-substituted amino moiety, a trialkylamino group, a pyrazoline-containing group, a stilbene-containing group, a hydrazone-containing group, an oxadiazole-containing group, a phthalocyanine-containing group, a naphthalocyanine-containing group, a porphyrin-containing group and a C₆₀-containing group, J₂ represents a polymerizable~~

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~~unsaturated monomer unit having at least one functional group, and p and q represent positive numbers.~~

Claim 5 (Canceled).

Claim 6 (Currently amended): The organic electroluminescent device according to claim 4, wherein ~~a functional group of the polymerizable unsaturated monomer unit~~ repeating unit J₁ is at least one functional group selected from a carboxyl group, ~~consisting of~~ a hydroxyl group, an amino group, an isocyanate group and an acid anhydride group.

Claims 7-9 (Canceled).

Claim 10 (Currently amended): The organic electroluminescent device according to claim [[9]] 26, wherein the group capable of forming covalent bonds with a functional group of the copolymer represented by the formula (8) is at least one selected from an amino group, an isocyanate group and a hydroxyl group.

Claim 11 (Currently amended): The organic electroluminescent device according to claim [[9]] 26, comprising two or more layers made of the copolymer represented by the formula (8), the copolymer layers of which are provided in the order of increase in an ionization potential from the anode.

Claim 12 (Original): An organic electroluminescent device comprising an anode, a hole transport layer, an emitter layer and a cathode, which are provided on a transparent support, wherein the hole transport layer comprises a layer made of a diarylamino group-containing copolymer of claim 1.

Claim 13 (Original): The organic electroluminescent device according to claim 12, wherein a coupling agent having an amino group is bonded with the surface of the anode, and the coupling agent and a layer made of the diarylamino group-containing copolymer are bonded through an amide bond or an imide bond.

Claim 14 (Original): The organic electroluminescent device according to claim 12, wherein the hole transport layer comprises a layer made of a compound having two or more amino groups per molecule, and a multi-layered structure in which at least one layer made of the diarylamino group-containing copolymer and at least one layer made of a compound having two or more amino groups per molecule are alternately laminated through an amide bond or an imide bond.

Claim 15 (Original): The organic electroluminescent device according to claim 14, wherein the multi-layered structure comprises two or more layers made of the diarylamino group-containing

copolymer, the layers of which are provided in the order of increase in an ionization potential from the anode.

Claim 16 (Withdrawn): A method of producing ~~a hole transport layer~~ for an organic electroluminescent device which has an anode, a hole transport layer, an emitter layer and a cathode, which are provided on a transparent support, the method comprising the steps of:

(I) bringing a solution containing a coupling agent having a functional group capable of forming covalent bonds with a functional group of the copolymer of claim [[4]] 1 into contact with the surface of the anode provided on the transparent support to form a layer made of the coupling agent, and

(II) bringing a solution containing the copolymer of claim [[4]] 1 into contact with the surface of the layer made of the coupling agent to form a layer made of the copolymer.

Claim 17 (Withdrawn): The method of producing ~~a hole transport layer~~ for an organic electroluminescent device according to claim 16, which further comprises the step of heating after each of the steps (I) and (II) or after the step (II).

Claim 18 (Withdrawn): The method of producing ~~a hole transport layer~~ for an organic electroluminescent device according to claim 16, wherein the functional group of the copolymer is

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a carboxyl group or an acid anhydride group, and the functional group of the coupling agent is an amino group.

Claim 19 (Withdrawn): The method of producing ~~a hole transport layer~~ for an organic electroluminescent device according to claim 16, which further comprises the following step of:
(III) bringing a solution containing a compound having two or more functional groups capable of forming covalent bonds with a functional group of the copolymer into contact with the surface of a layer made of the copolymer to form a layer made of the compound, after the step (II).

Claim 20 (Withdrawn): The method of producing ~~a hole transport layer~~ for an organic electroluminescent device according to claim 19, which further comprises the step of heating after the step (III).

Claim 21 (Withdrawn): The method of producing ~~a hole transport layer~~ for an organic electroluminescent device according to claim 19, wherein the functional group of the compound having two or more functional groups capable of forming covalent bonds with a functional group of the copolymer is an amino group.

Claim 22 (Withdrawn): A method of producing ~~a hole transport layer~~ for an organic electroluminescent device in an organic electroluminescent device comprising an anode, a hole

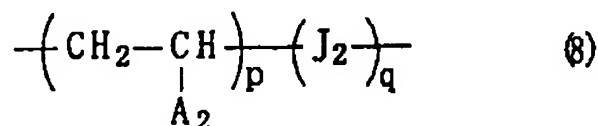
transport layer, an emitter layer and a cathode, which are provided on a transparent support, the method comprising the steps of:

- (i) bringing a solution containing a coupling agent having a functional group capable of forming covalent bonds with a functional group of the copolymer of claim [[4]] 1 into contact with the surface of the anode provided on the transparent support to form a layer made of the coupling agent,
- (ii) bringing a solution containing the copolymer of claim [[4]] 1 into contact with the surface of the layer made of the coupling agent to form a layer made of the copolymer,
- (iii) bringing a solution containing a compound having two or more functional groups capable of forming covalent bonds with a functional group of the copolymer of claim [[4]] 1 into contact with the surface of the layer made of the copolymer to form a layer made of the compound, and
- (iv) alternately laminating at least one layer made of the copolymer of claim [[4]] 1 and at least one layer made of a compound having two or more functional groups capable of forming covalent bonds with a functional group of the copolymer, in this order, after the step (iii).

Claim 23 (Withdrawn): The method of producing ~~a hole transport layer~~ for an organic electroluminescent device according to claim 22, which further comprises the step of heating after each of the steps (i) to (iv) or after any step.

Claim 24 (Withdrawn): The method of producing ~~a hole transport layer~~ for an organic electroluminescent device according to claim 22, wherein ~~the functional group of the copolymer has~~ a functional group that is a carboxyl group or an acid anhydride group, and the functional groups of both the coupling agent and the compound having two or more functional groups capable of forming covalent bonds with a functional group of the copolymer are amino groups.

Claim 25 (New): An organic electroluminescent device comprising an anode, a hole transport layer, an emitter layer and a cathode, which are provided on a transparent support, wherein the hole transport layer comprises a layer made of a copolymer represented by following formula (8):

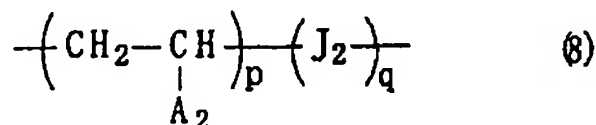


and in the formula (8), A₂ represents a group selected from the group consisting of an N,N-diaryl-substituted amino group, a group having an N,N-diaryl-substituted amino moiety, a trialkylamino group, a pyrazoline-containing group, a stilbene-containing group, a hydrazone-containing group, an oxadiazole-containing group, a phthalocyanine-containing group, a naphthalocyanine-containing group, a porphyrin-containing group and a C₆₀-containing group, J₂ represents a polymerizable unsaturated monomer unit having at least one functional group, and p and q represent positive

numbers,

wherein a coupling agent having a group capable of forming covalent bonds with a functional group of a copolymer represented by the formula (8) is fixed on the anode surface, and the anode and a layer made of the copolymer represented by the formula (8) are bonded by covalent bonds via the coupling agent.

Claim 26 (New): An organic electroluminescent device comprising an anode, a hole transport layer, an emitter layer and a cathode, which are provided on a transparent support, wherein the hole transport layer comprises a layer made of a copolymer represented by following formula (8):



and in the formula (8), A₂ represents a group selected from the group consisting of an N,N-diaryl-substituted amino group, a group having an N,N-diaryl-substituted amino moiety, a trialkylamino group, a pyrazoline-containing group, a stilbene-containing group, a hydrazone-containing group, an oxadiazole-containing group, a phthalocyanine-containing group, a naphthalocyanine-containing group, a porphyrin-containing group and a C₆₀-containing group, J₂ represents a polymerizable unsaturated monomer unit having at least one functional group, and p and q represent positive numbers,

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wherein the hole transport layer has a multi-layered structure in which at least one layer made of the copolymer represented by the formula (8) and at least one layer made of a compound having two or more groups per molecule which are capable of forming covalent bonds with a functional group of the copolymer layer are alternately laminated via covalent bonds.